Prix agricoles et régulation: mouvements extrêmes et anticipation

EIFR, 13 avril 2016

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Outline

- Motivation and main results
- The 2006/2007 structural jump
- Identification of five agricultural prices extreme moves
- Explanation by stock-to-use and index flows information
- Prediction
  - Price-based signals
  - Stock-to-use signals
  - Flows/volumes signals
- Conclusion

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Motivation of the study

- Over the last decade, exceptional fluctuations have been observed on agricultural prices:
  - End of may 2007- end of feb 2008, the Goldman Sachs Agriculture Index rises by about 100%
  - March – dec 2008: falls by 50%
  - End of june 2010 - Feb 2011: +100% again
  - From june to july 2012, rises by 40%, then falls by 45% from July 2012 to september 2014.
- Tremendous social and political consequences for developing countries and for farmers in high and low income countries
- There are numerous studies on the 2007-2008 food crisis and on the impact of index speculators on food prices
- So far, no study on the anticipation of extreme food price fluctuations

Three objectives

- Define objectively what is an « extreme price fluctuation »
- Try to explain these extreme fluctuations
- Identify predictive signals of extreme price fluctuations

- Variables used:
  - USDA information about harvest, consumption, stock-to-use
  - Investors' flows, positions (CFTC) and volumes at the CBOT
  - Past price information

Main results 1/2

- Structural jump identified in agricultural prices in 2006/2007: may be largely attributed to the rise of biofuels (ethanol, biodiesel)

- Extreme price movement = outlier of the distribution **over the associated time horizon**

-> 5 extreme price movements:

  - may 2007- feb 2008 : +94%
  - mar 2008- dec 2008 : -50%
  - jun 2010- feb 2011 : +91%
  - Jun- jul 2012 : +40%
  - jul 2012 –sept 2014 : -45%

Main results 2/2

- Index flows/stock-to-use information explain a variable part of these fluctuations (within a constant coefficient linear model)
  - Index flows may explain between 50% and 100% of the 2007 rise and the 2008 fall, but may not explain other extreme movements
  - Stock-to-Use information may explain more than half of the 2007, 2010 and 2012-2014 price movements, but 25% only of the 2008 and 2012 movements
- We retain 5 predictive signals for extreme price fluctuations:
  - 3 price-based signals:
    - Extreme moves of shorter time horizon
    - Implied volatility
    - Deviations to long-term relations between grains/locations/maturities
  - Breaking points in the Stock-to-use/price relation
  - Positive deviations of volumes to the long-term price/volume relation

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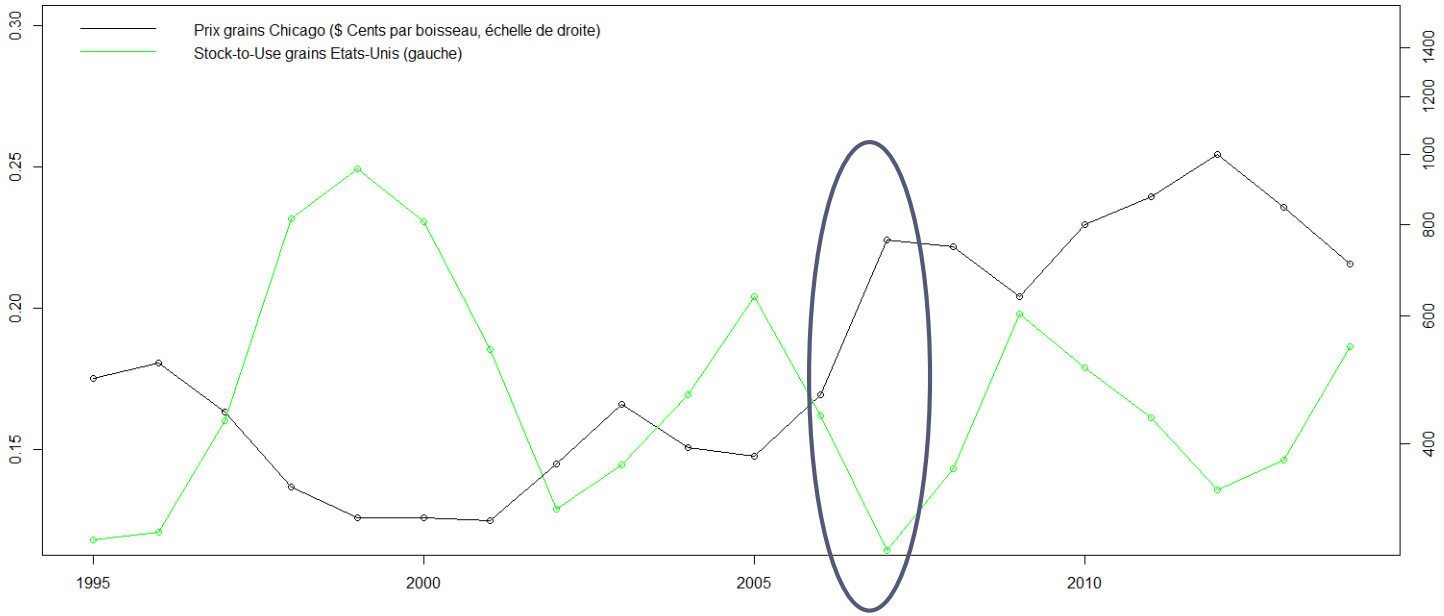
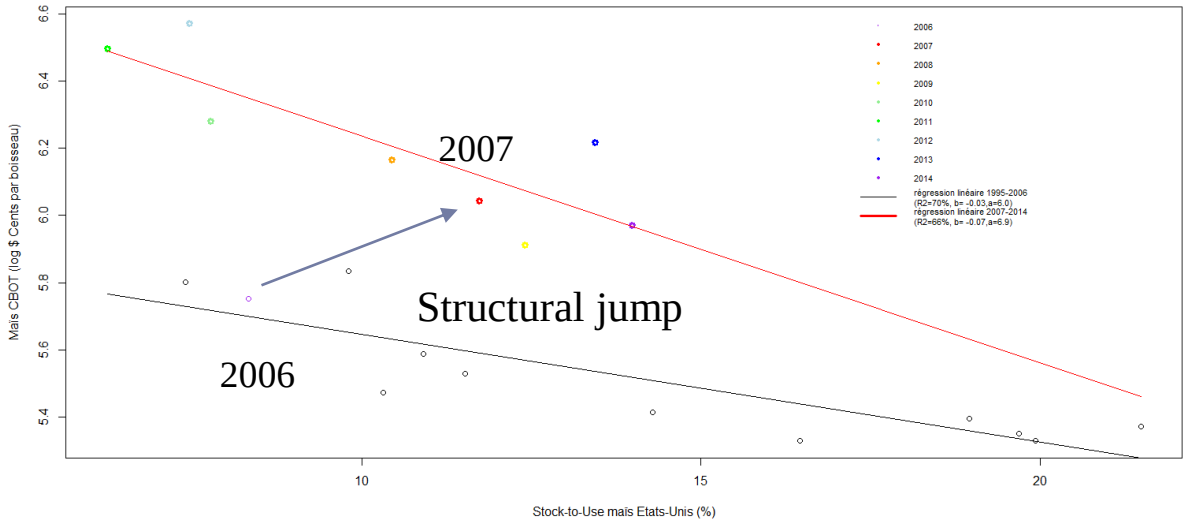
The 2006/2007 structural jump



Structural jump

Average of the three grain markets

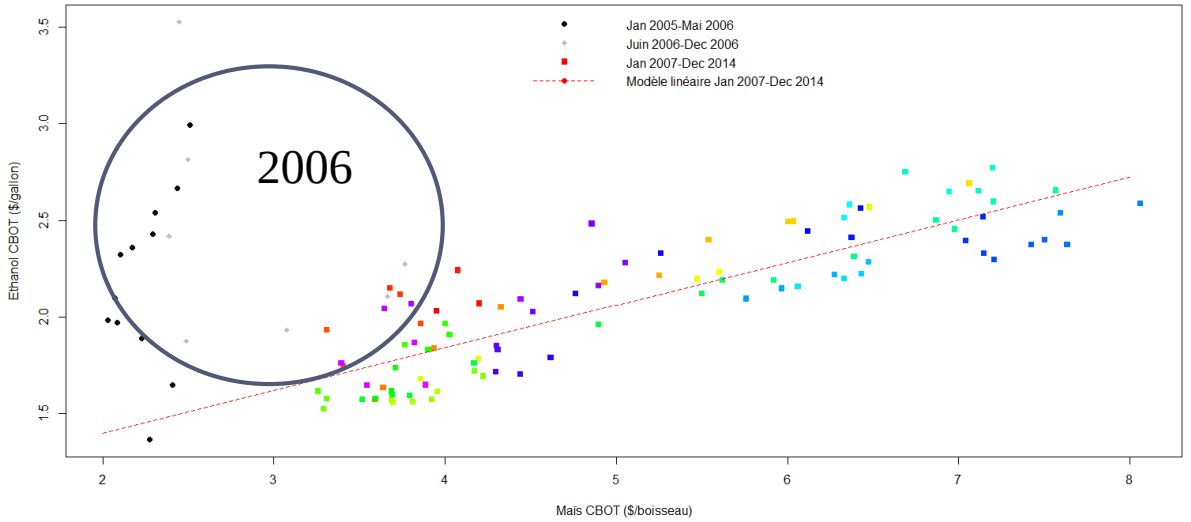
The 2006/2007 structural jump



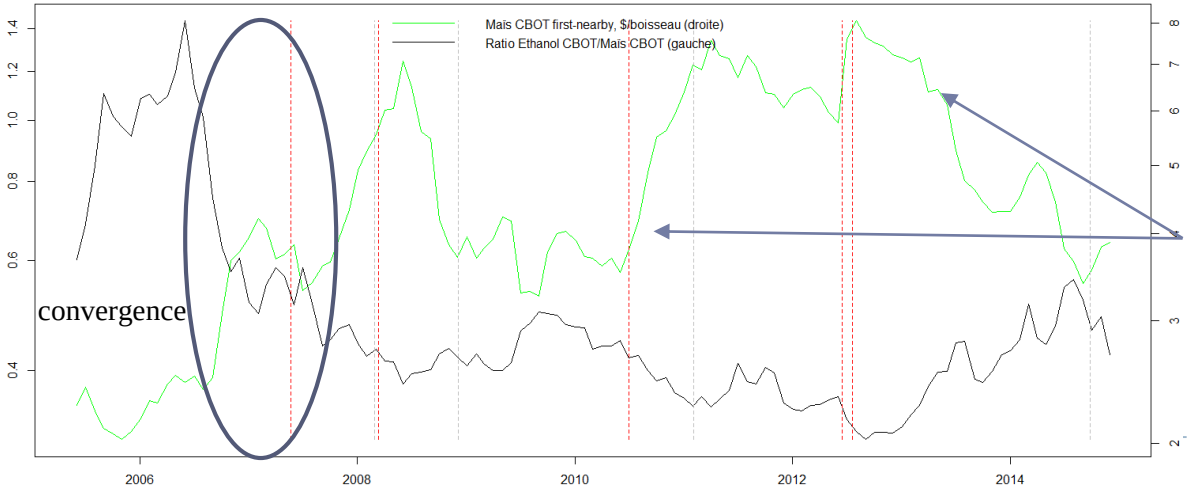
US corn

The 2006/2007 structural jump is probably due to the rise of biofuels in the years 2000 (structural rise in demand)

Corn/ethanol relation



Corn/ethanol ratio



corn leads the relation after 2008

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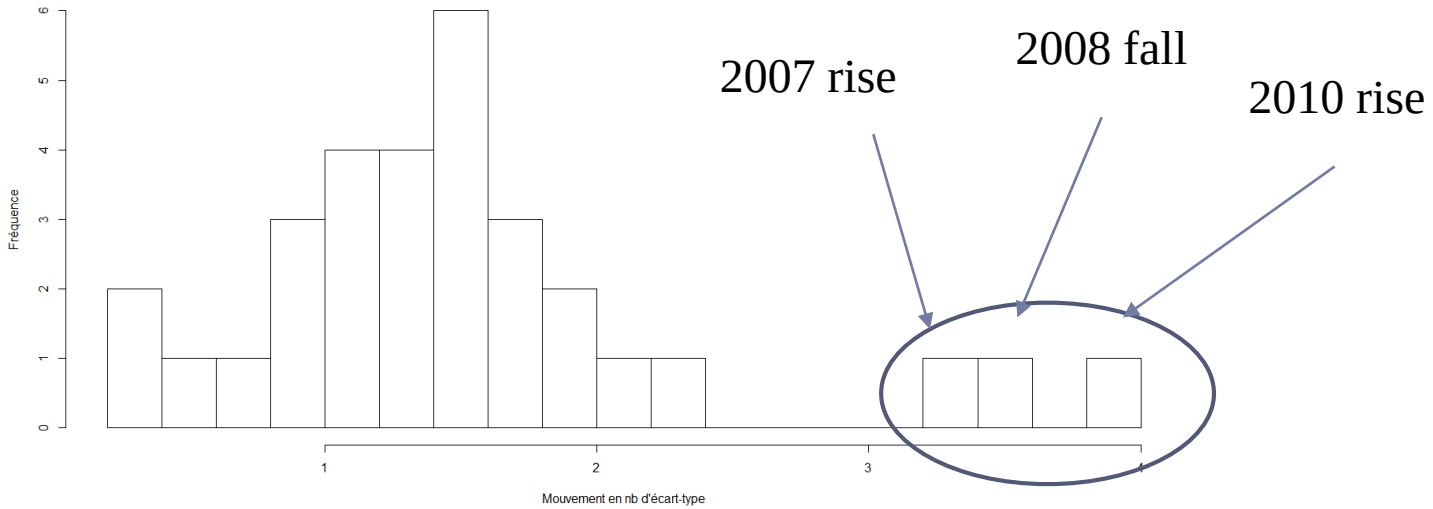
Extreme moves identification imposing a window size of 150 days

Histogram of absolute moves with a fixed horizon of 150 days (period 1990-2014)

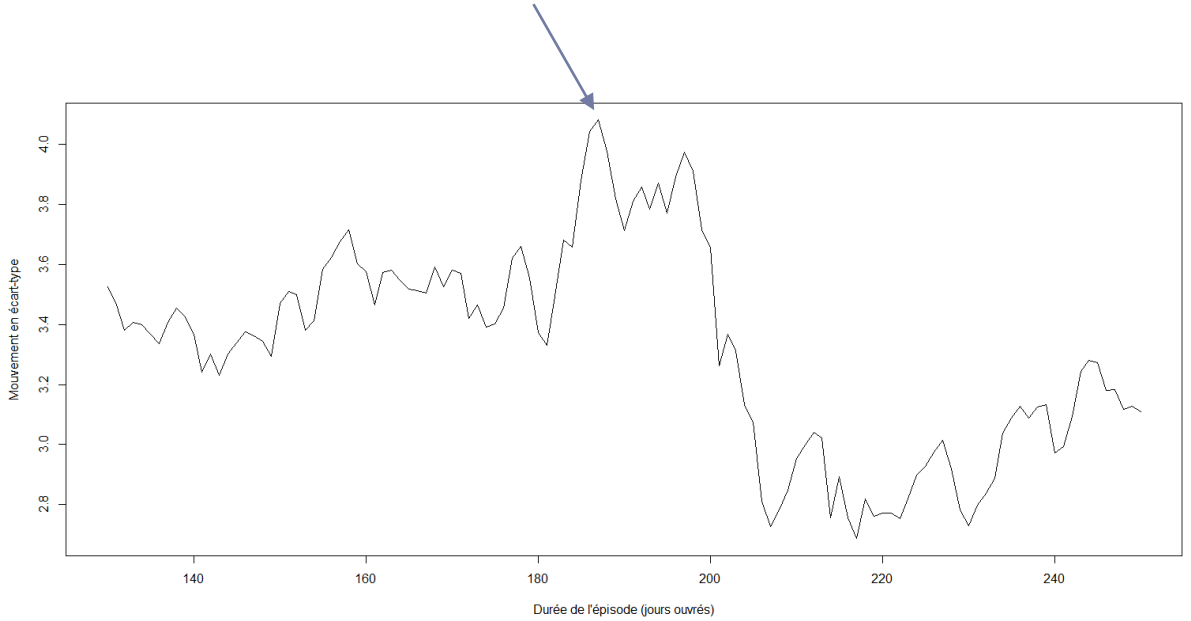


3 outliers (more than 3 sd)

We find the 150-days windows where the largest absolute moves have been observed
We then remove overlapping observations

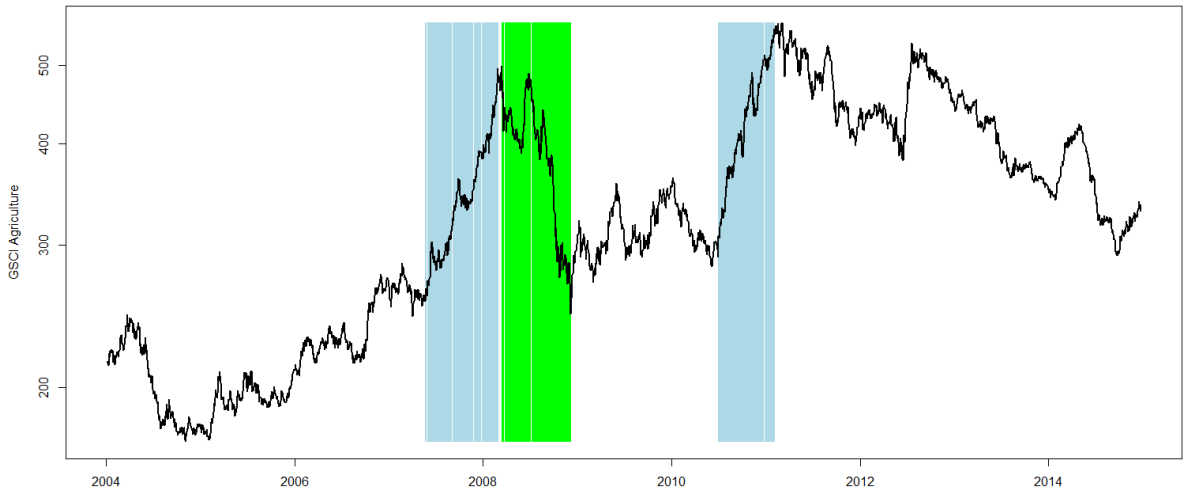
Extreme moves identification
calibration of the window size for the 2008 fall

187 trading days



Identification of the window size leading to the most extreme move (in n° of std) for the 2008 fall: 4.1 standard deviations move

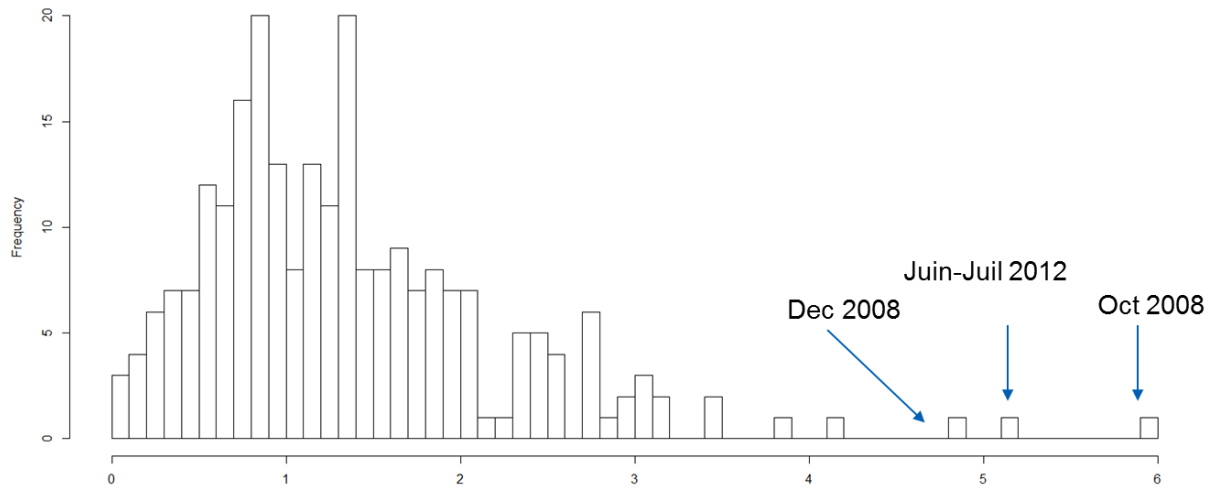
Extreme moves identification
first three extreme moves (100 to 250 days)



Identification of the window size leading to the most extreme move (in n° of std) for the 2008 fall: 4.1 standard deviations move

Extreme moves identification imposing a window size of 20 days

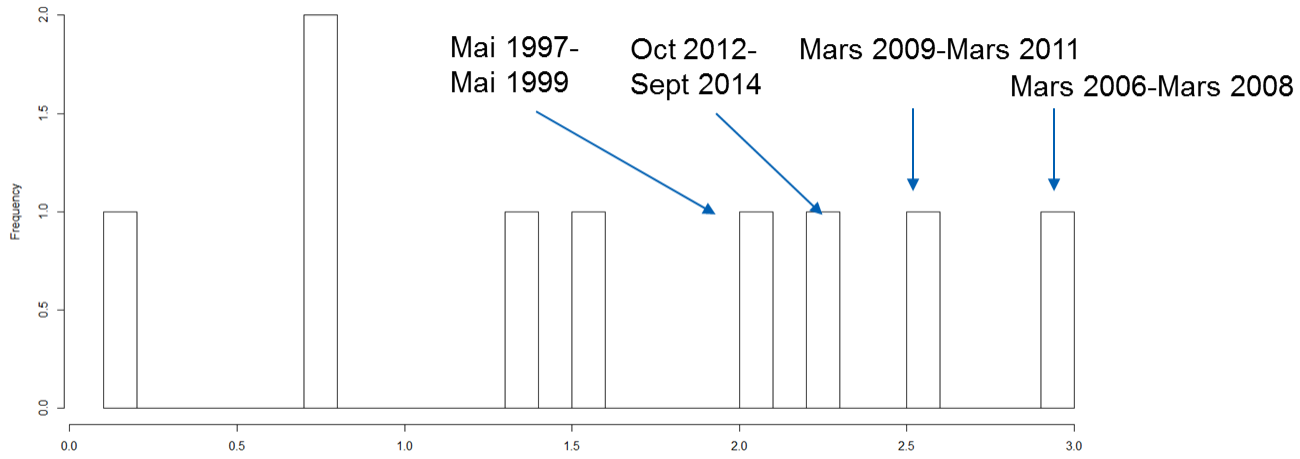
Histogram of absolute moves with a fixed horizon of 20 days



We find the 20-days windows where the largest absolute moves have been observed
We then remove overlapping observations

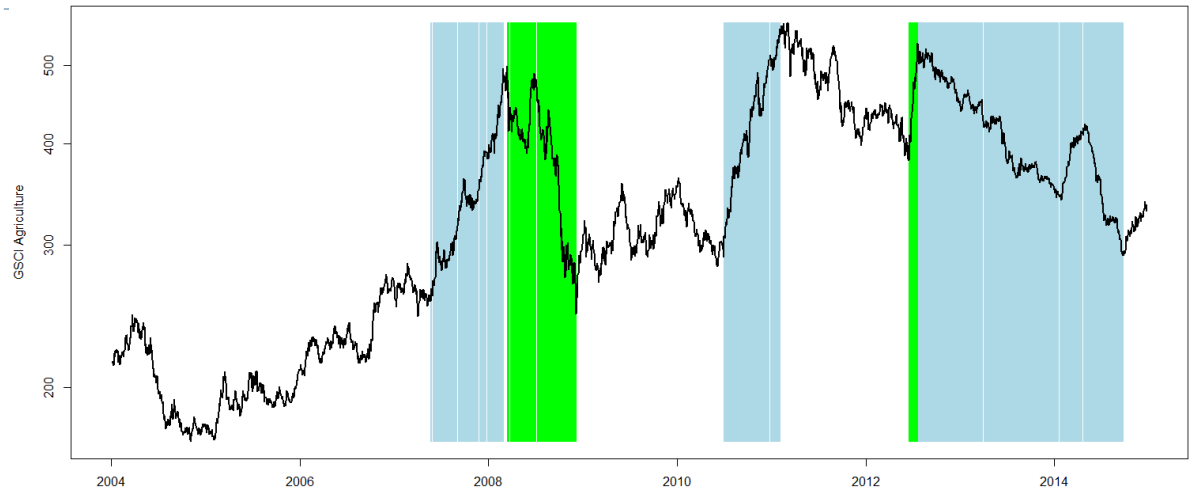
Extreme moves identification imposing a window size of 500 days

Histogram of absolute moves with a fixed horizon of 500 days



We find the 20-days windows where the largest absolute moves have been observed
We then remove overlapping observations

Extreme moves identification Recap



1) May 2007- feb 2008: 195 trading days, 3.6 std, + 94%

2) March 2008 - december 2008 : 187 trading days, 4.1 std, -50%

3) jun 2010- feb 2011 : 151 trading days, 4 std, + 91%

4) jun- july 2012 : 24 trading days, 5.5 std, +40%

5) july 2012 to sept 2014 : 552 trading days, 2.4 std, -45%

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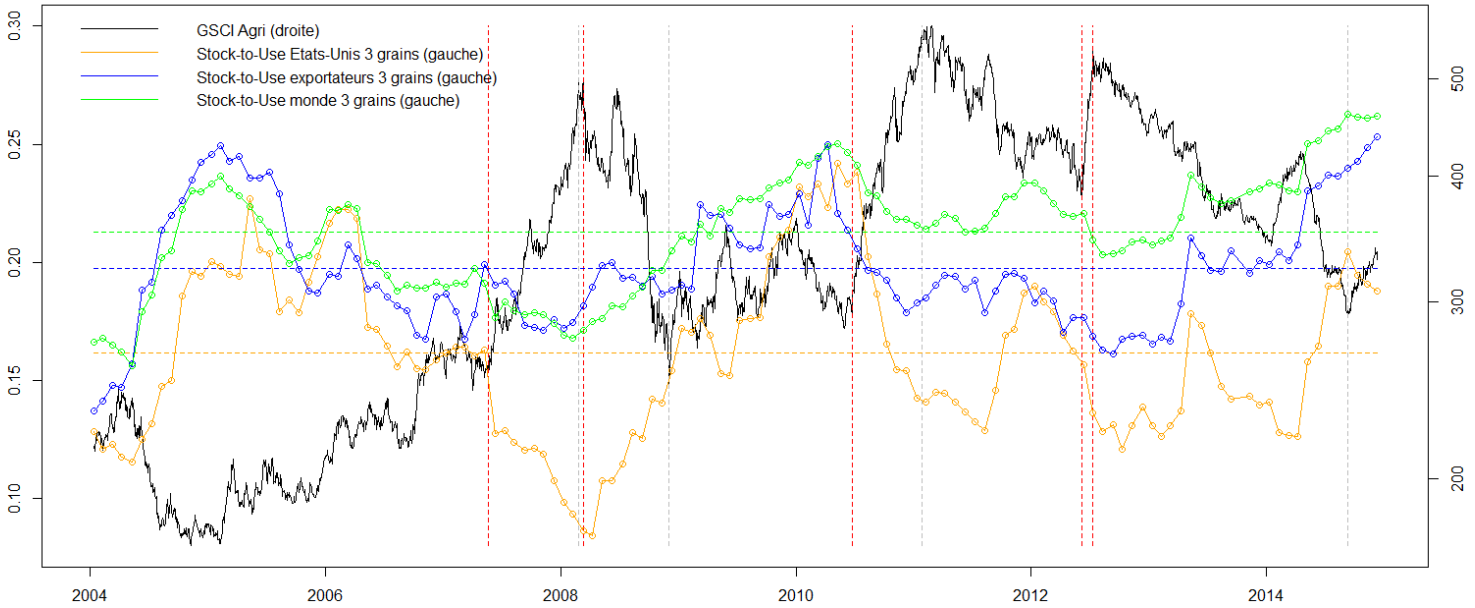
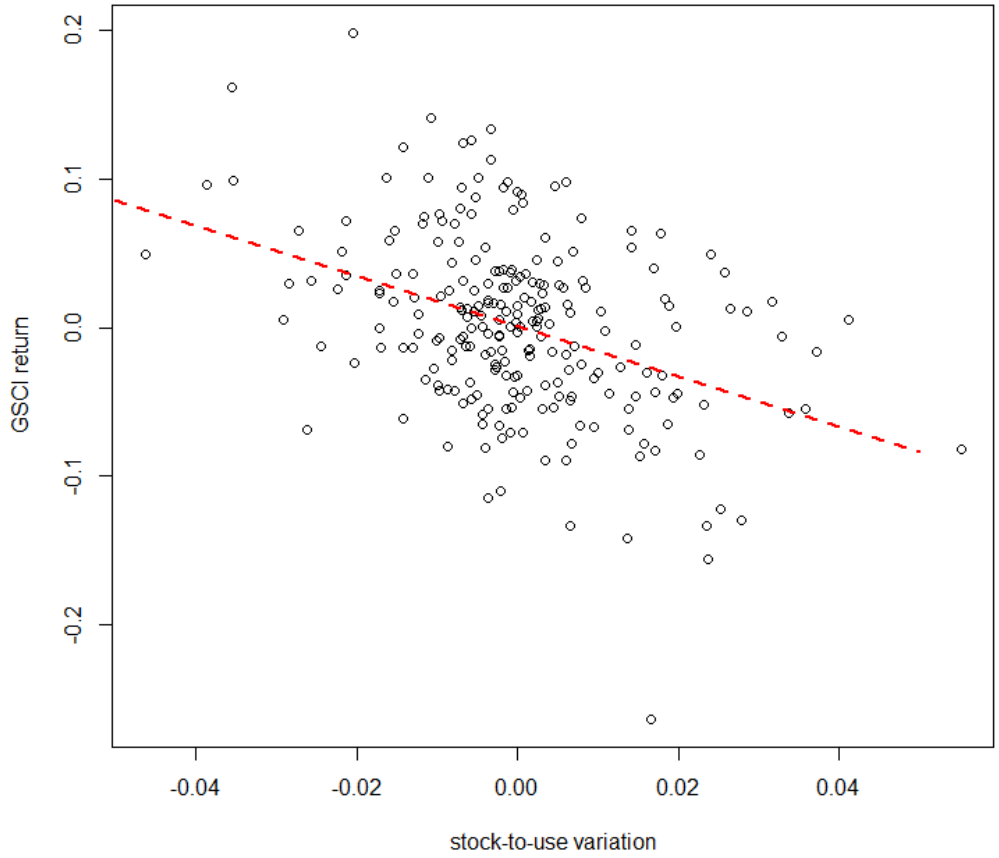
The role of stock-to-use information



The stock-to-use information is provided every month by the USDA (end of campaign stocks)

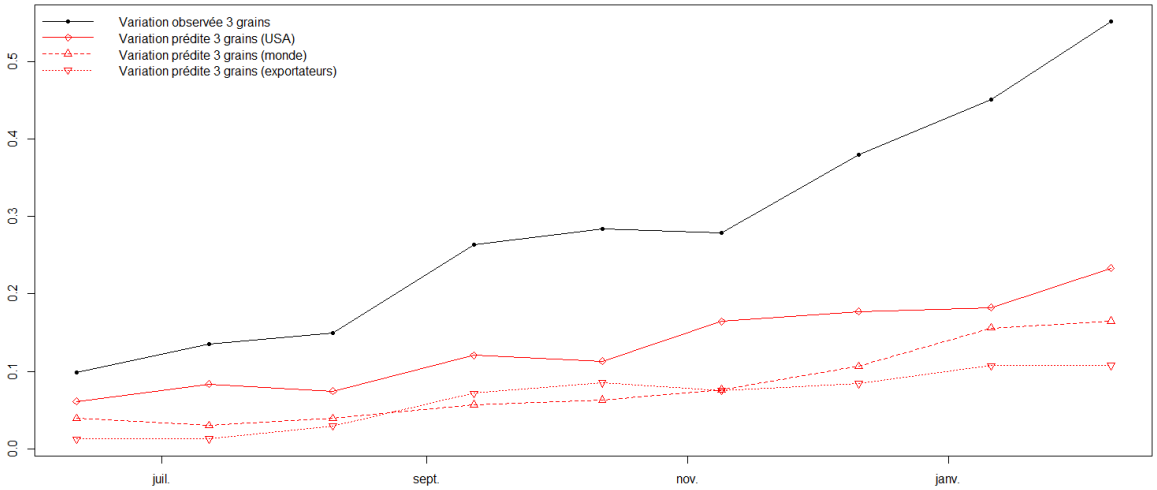
The 2007 rise is the only one which has been preceded by STU (slightly) below their long-term average

A strong negative correlation between STU revisions and price returns

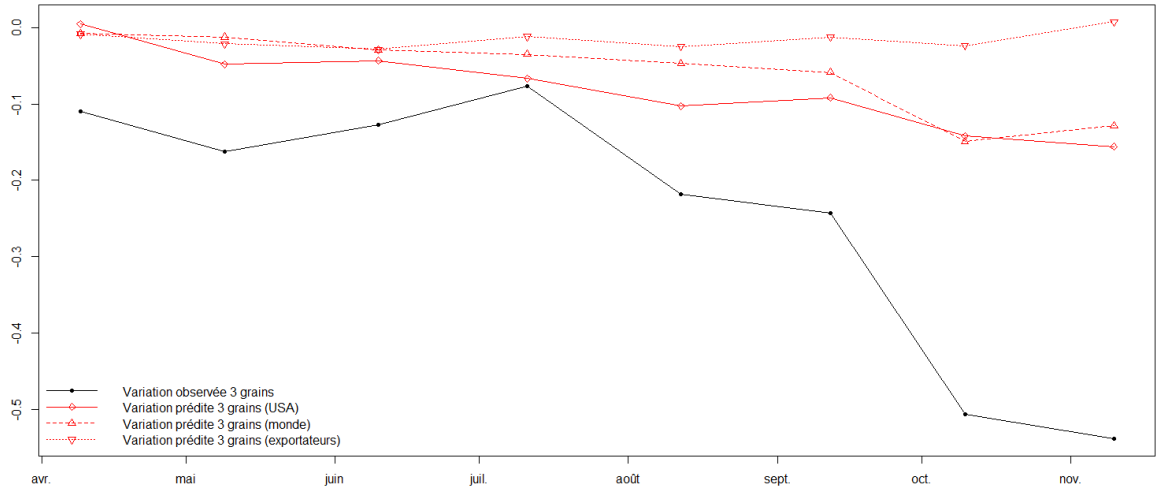


R2 = 15%
Slope = -1.7

May STU revisions explain the 5 extreme moves?

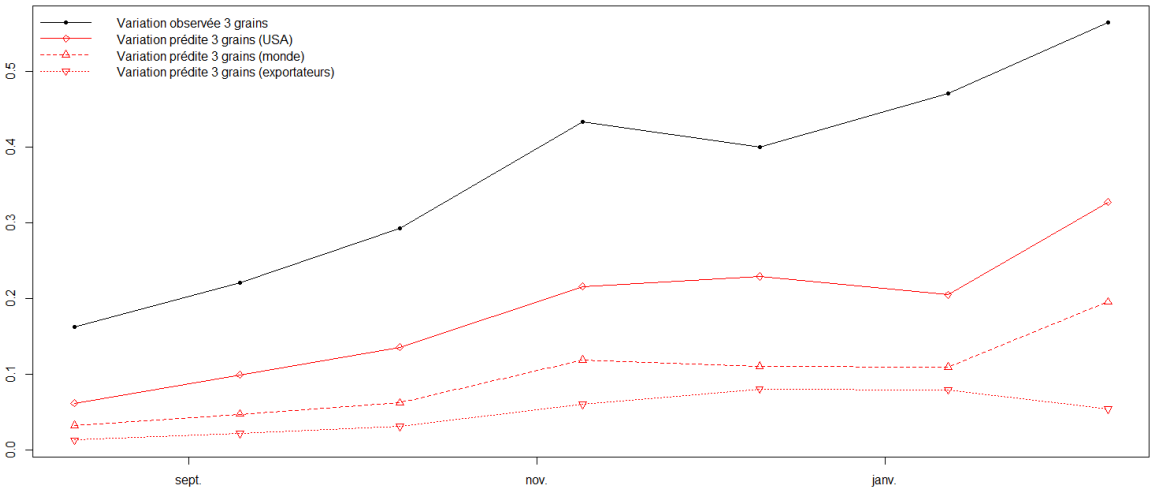


2007 rise

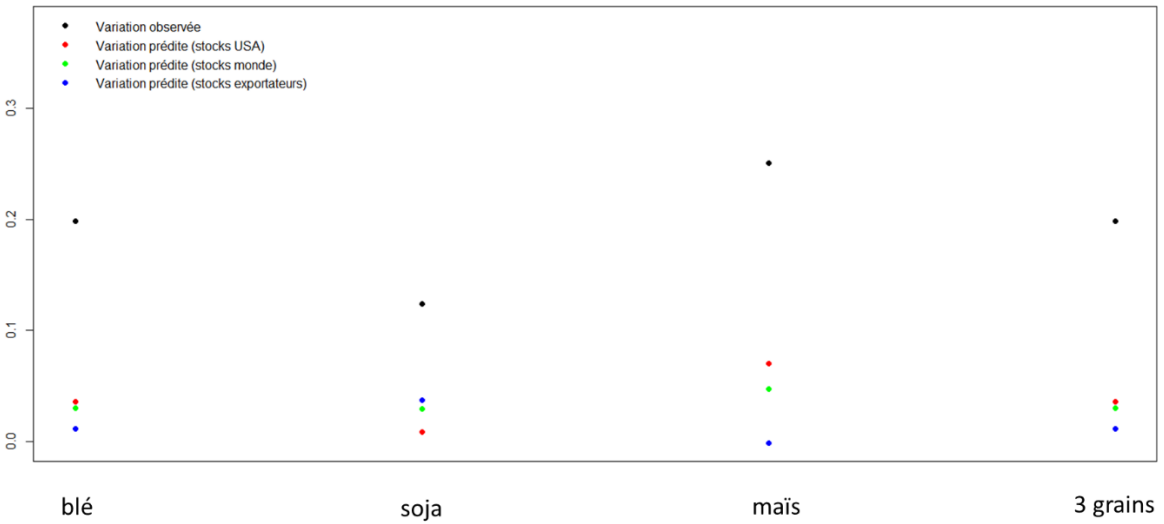


2008 fall

May STU revisions explain the 5 extreme moves?

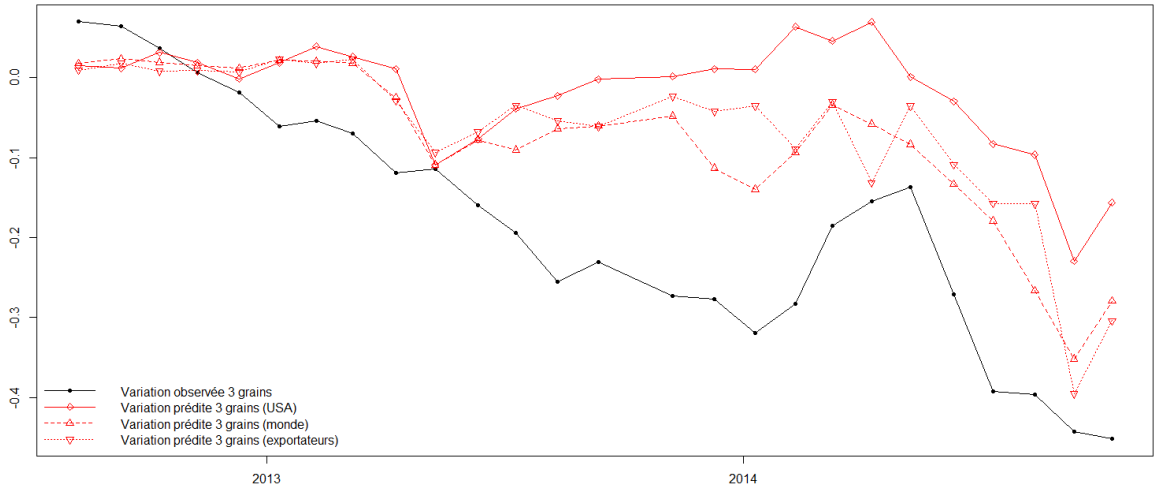


2010 rise



2012 rise

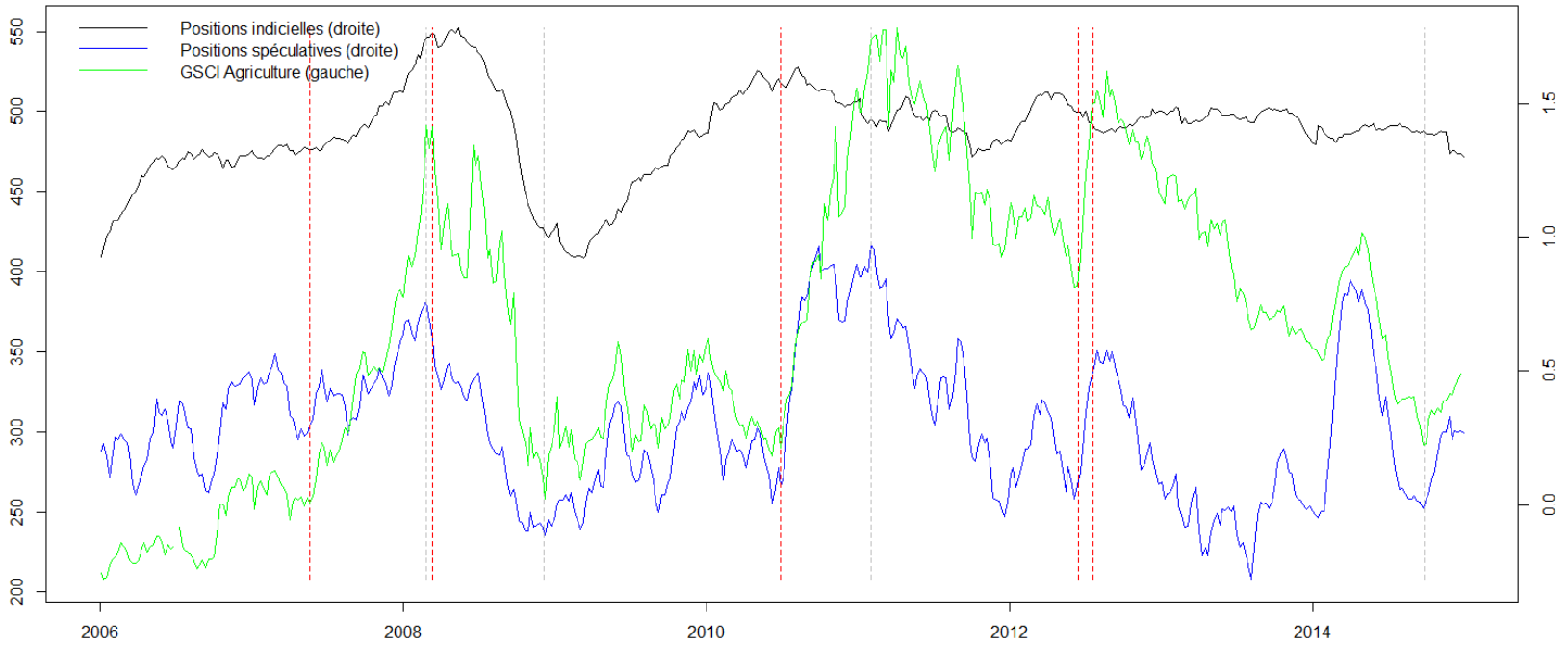
May STU revisions explain the 5 extreme moves?



2012-2014 fall

Stock-to-Use information may explain more than half of the 2007, 2010 and 2012-2014 price movements, but 25% only of the 2008 and 2012 movements

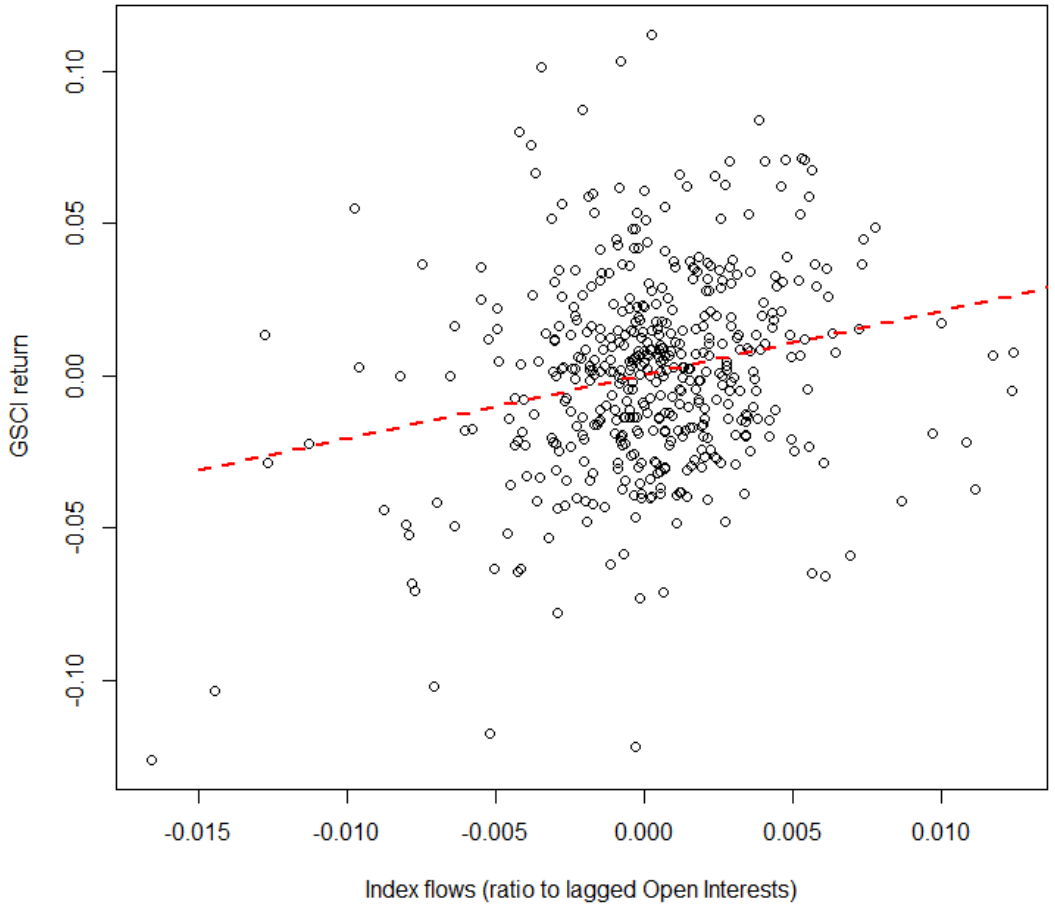
The role of index investment



The index/speculative flows information is provided on a weekly basis by the CFTC

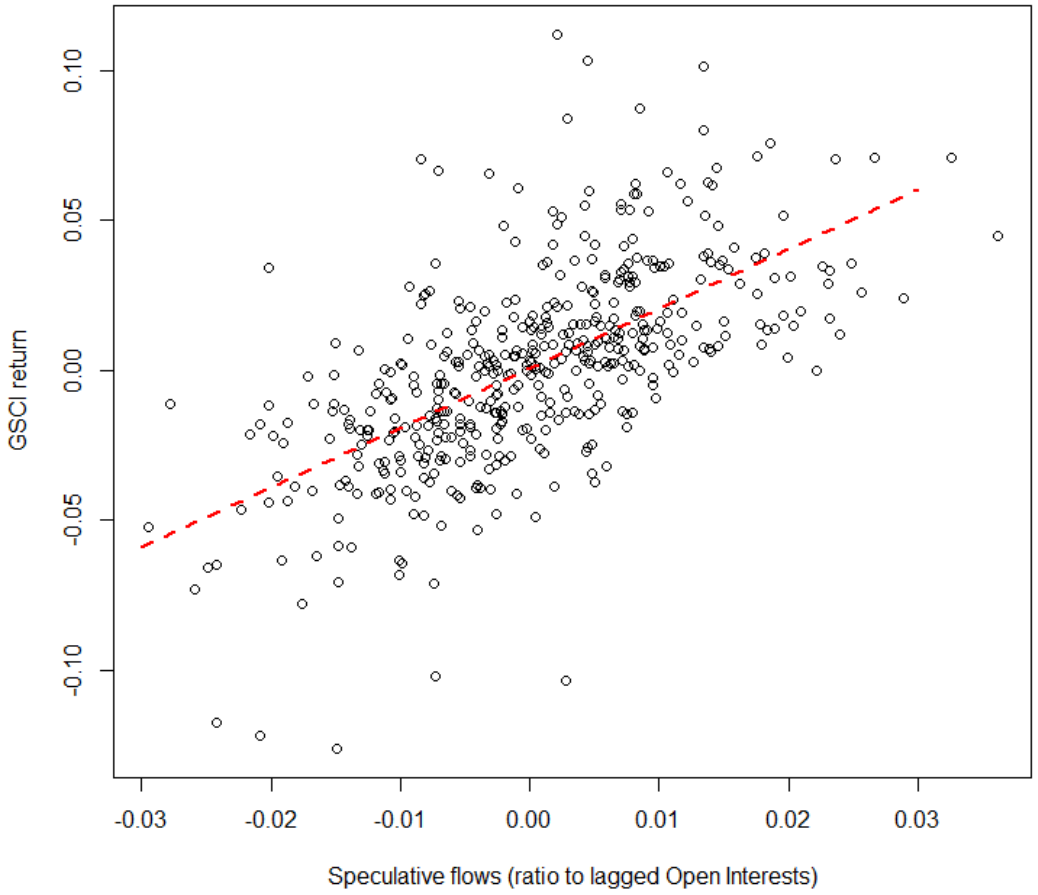
We consider aggregated positions on 12 agricultural markets (in million lots)

A mild positive correlation between index flows and price returns



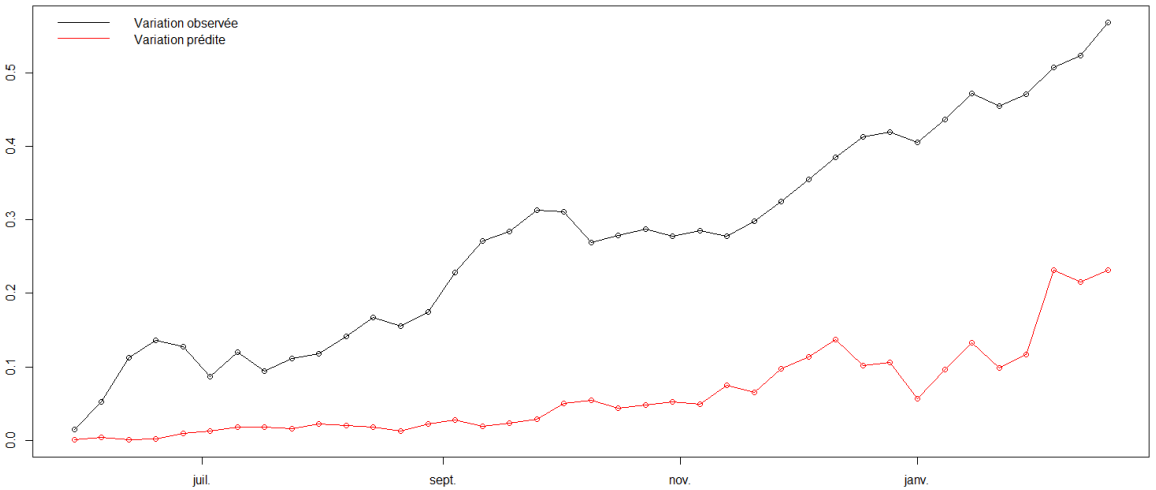
R2 = 5%
Slope = 2.1

A strong positive correlation between speculative flows and price returns…but a strong endogeneity problem to assess the causal link

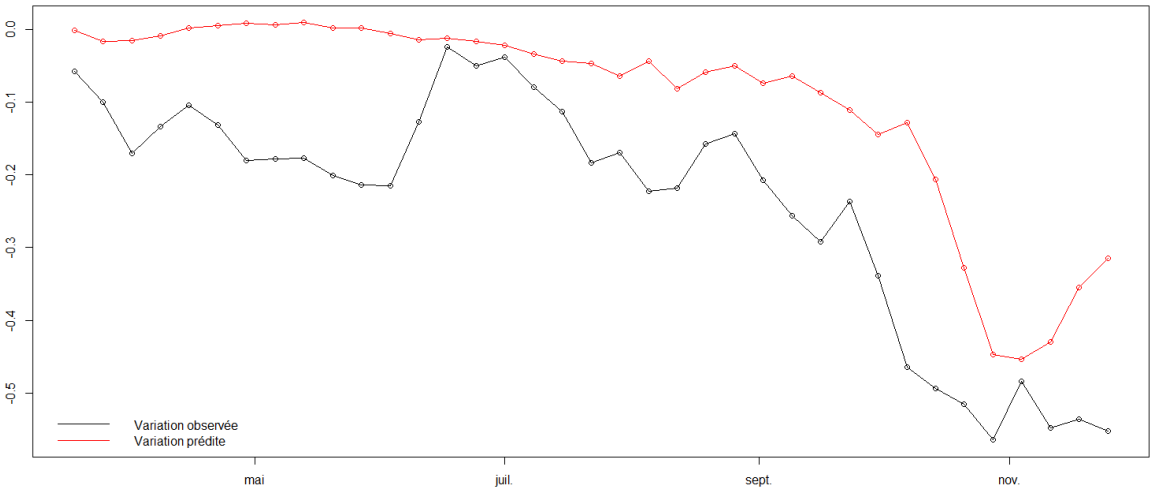


R2 = 40%
Slope = 2.0

May index flows explain the 5 extreme moves?

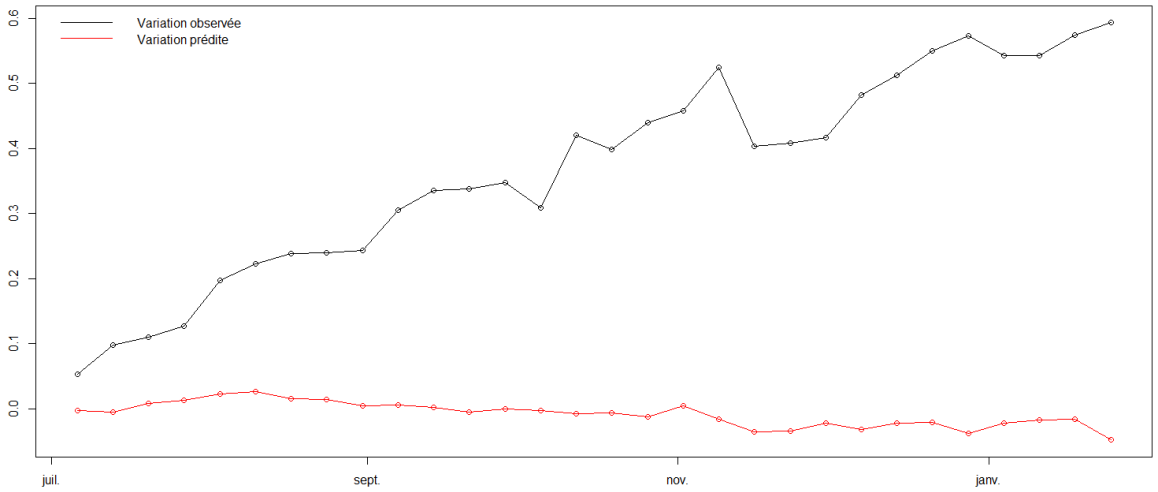


2007 rise

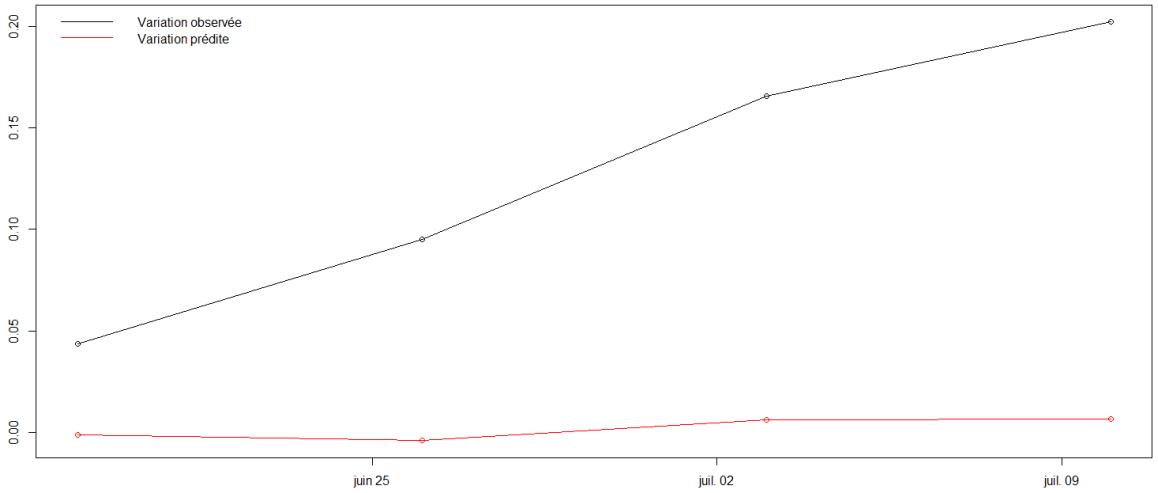


2008 fall

May index flows explain the 5 extreme moves?



2010 rise



2012 rise

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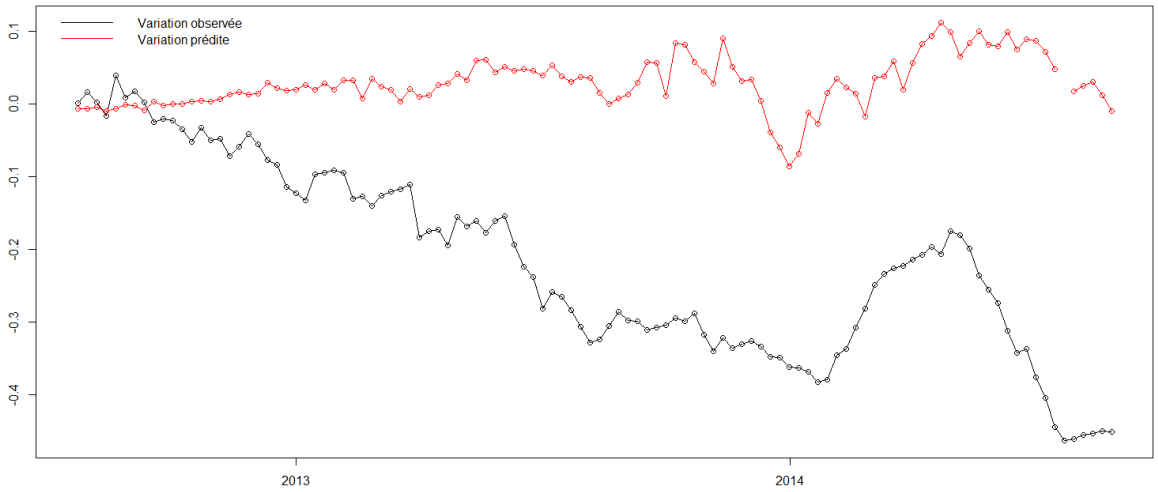

2012-2014 fall

Index flows may explain between 50% and 100% of the 2007 rise and the 2008 fall, but may not explain other extreme movements

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Price-based signals: short-horizon extreme moves

- Short-term extreme moves are interesting for two reasons:
  - Inform on fundamental information held by market participants but only partially incorporated into the prices (slow diffusion of information)
  - Inform on speculative positioning (speculators are trend followers in aggregate)

  -> potential of self-fulfilling rises/falls
  - The direction of the potential future extreme move is predicted

- We need to quantify these extreme moves objectively

-> large sample of horizons should be considered (from 1 to 100 days)

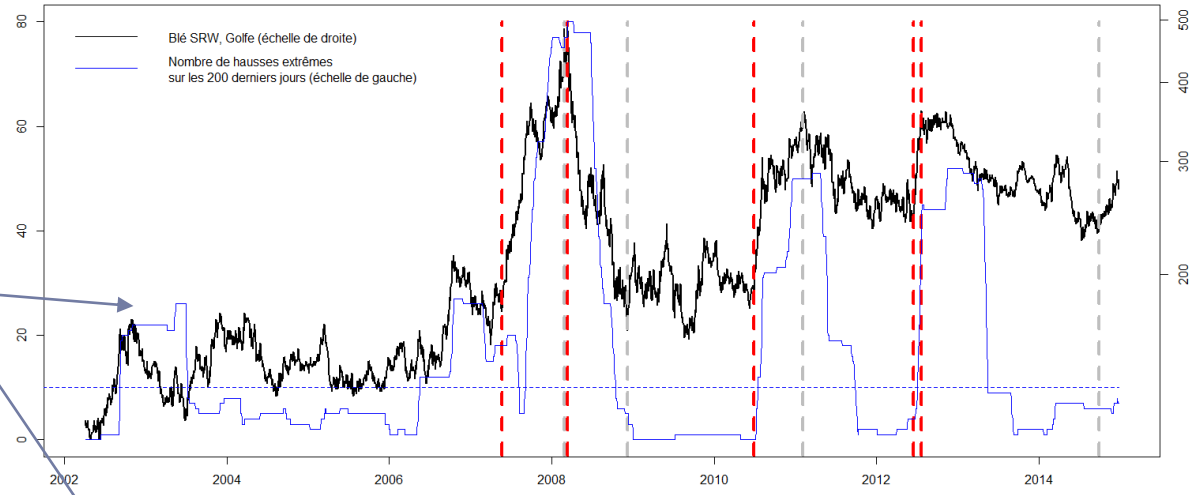
-> expressed in standard deviations (over the corresponding time horizon)

-> should exceed a certain threshold once expressed in n° of standard deviations (e.g. 3 sd)

- We evaluate the number of « extreme moves » within a rolling window (e.g. 200 days)

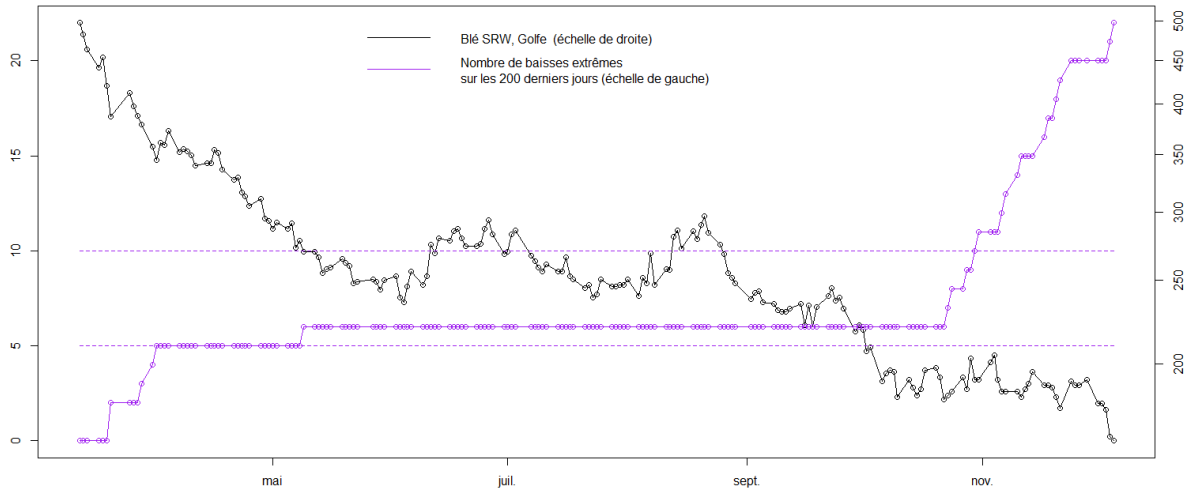
Price-based signals: short-horizon extreme moves

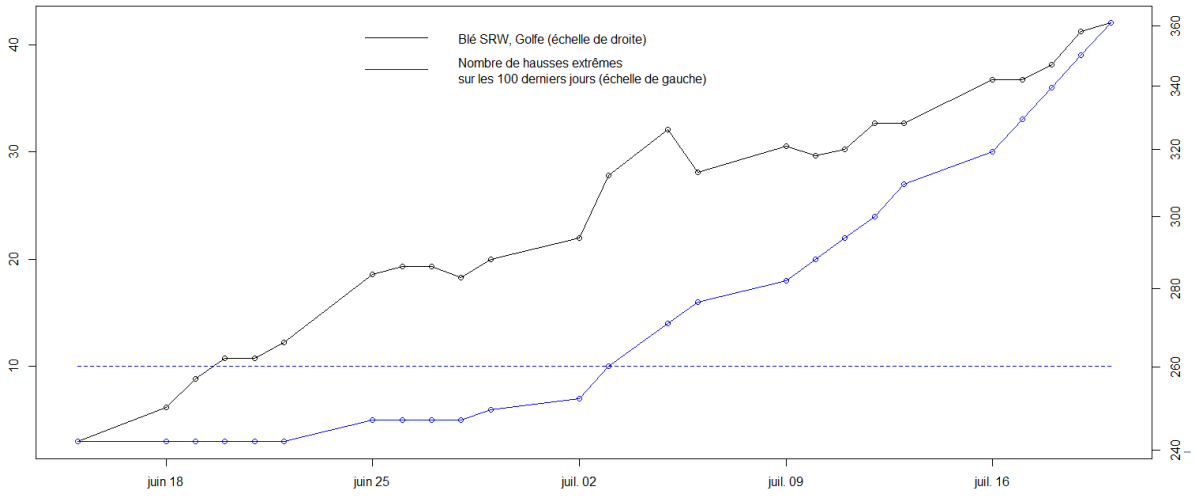
False signal



Late signal

Price-based signals: short-horizon extreme moves





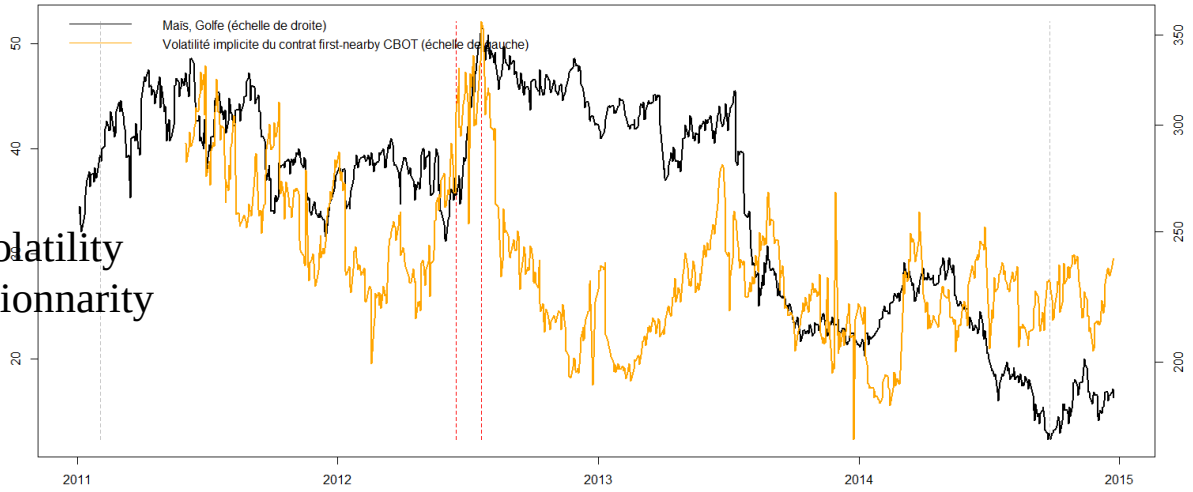
Price-based signals: implied volatility

- Implied volatility convey anticipations of market participants regarding future extreme moves
- Forward looking and instantaneous market prices
- Better suited than historical volatilities to predict extreme moves

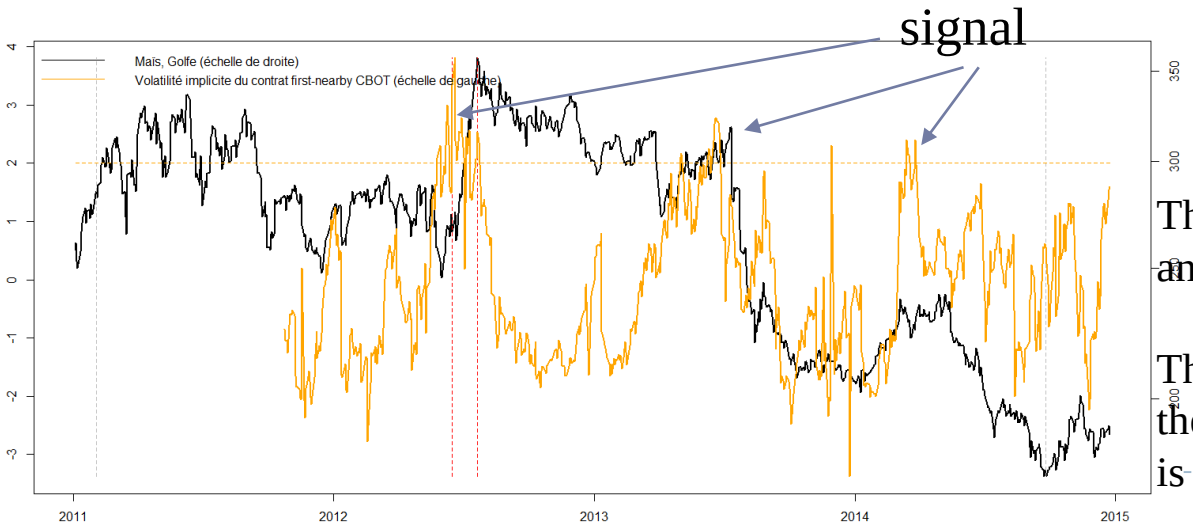
- Caution: the direction of the future extreme move is not predicted!
  - Correlation IV/prices
  - Difference between call/put prices of comparable strikes

Price-based signals: implied volatility

Raw implied volatility
Problem of stationnarity



Z-score



The signal is noisy and often anticipative

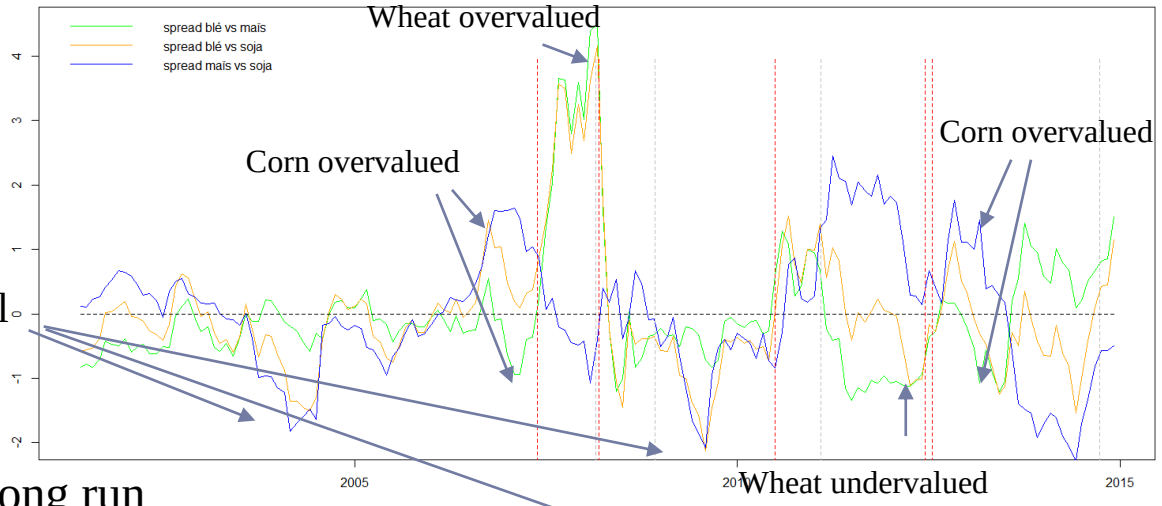
The direction of the future extreme move is not predicted!

Price-based signals: deviations to long-run price equilibriums

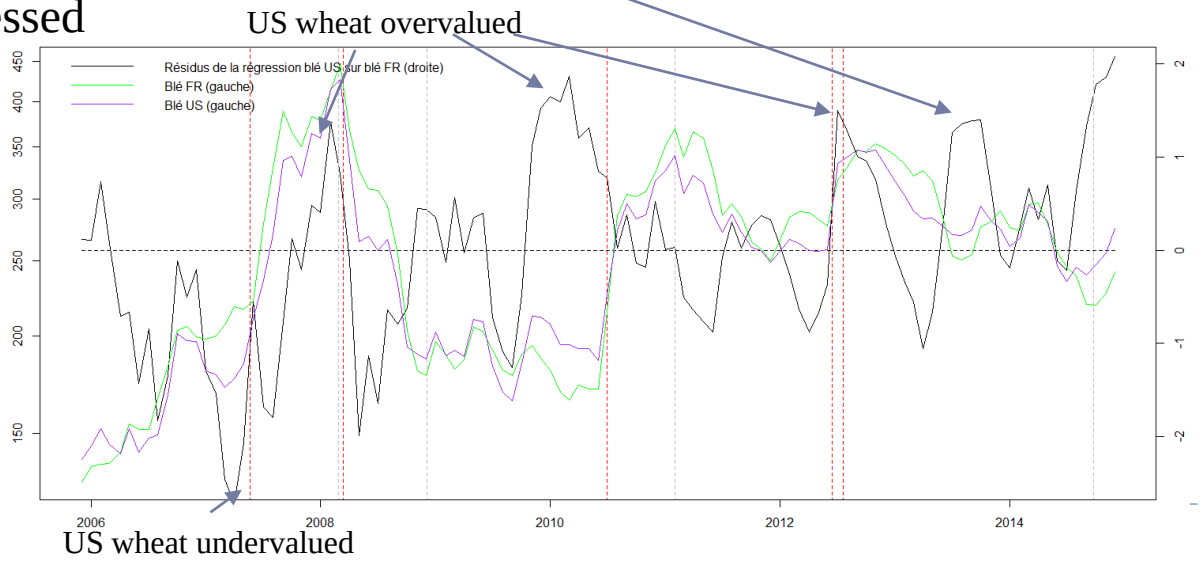
- There are strong long-run relationships between grains/locations/maturities
- Large deviations to these long-run relationships signal tensions in some markets, that are difficult to arbitrage away
- These tensions are often corrected at the occasion of large price moves (the tensions are appeased or propagate to other markets)
- A simple way to obtain them is to compute the residual of the long-run (log) price relationships (in n° of std)

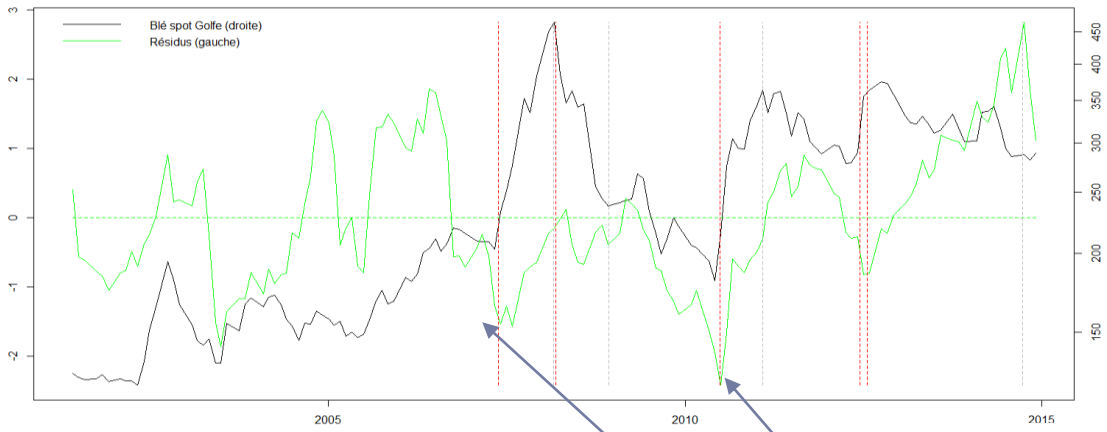
Strong long-run relations between the three main grain markets

Price-based signals: deviations to long-run price equilibriums



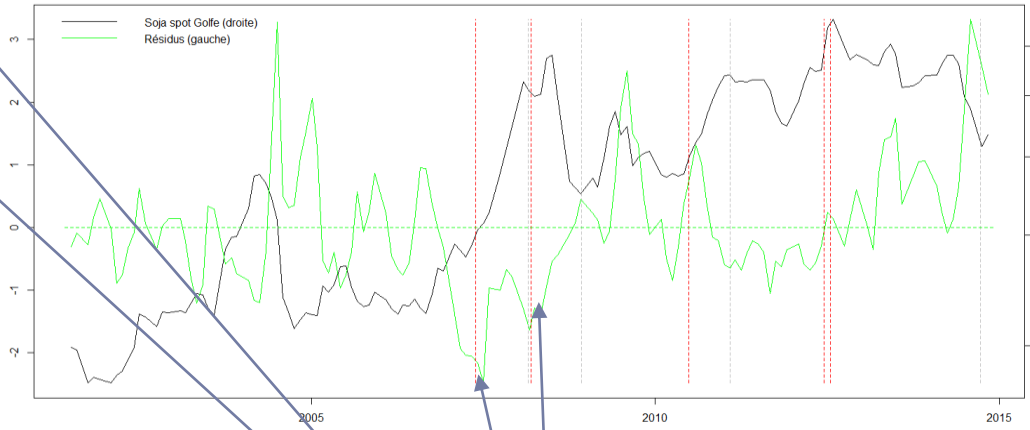
Residuals to the long run relation are expressed in n° of sd

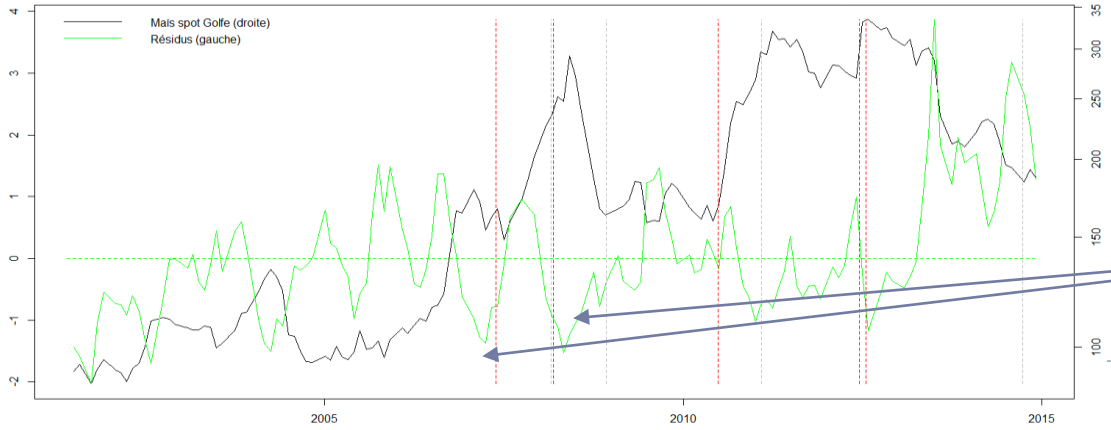




Residuals to the long run relation are expressed in n° of sd

Spread spot/first-nearby





Large spot undervaluation

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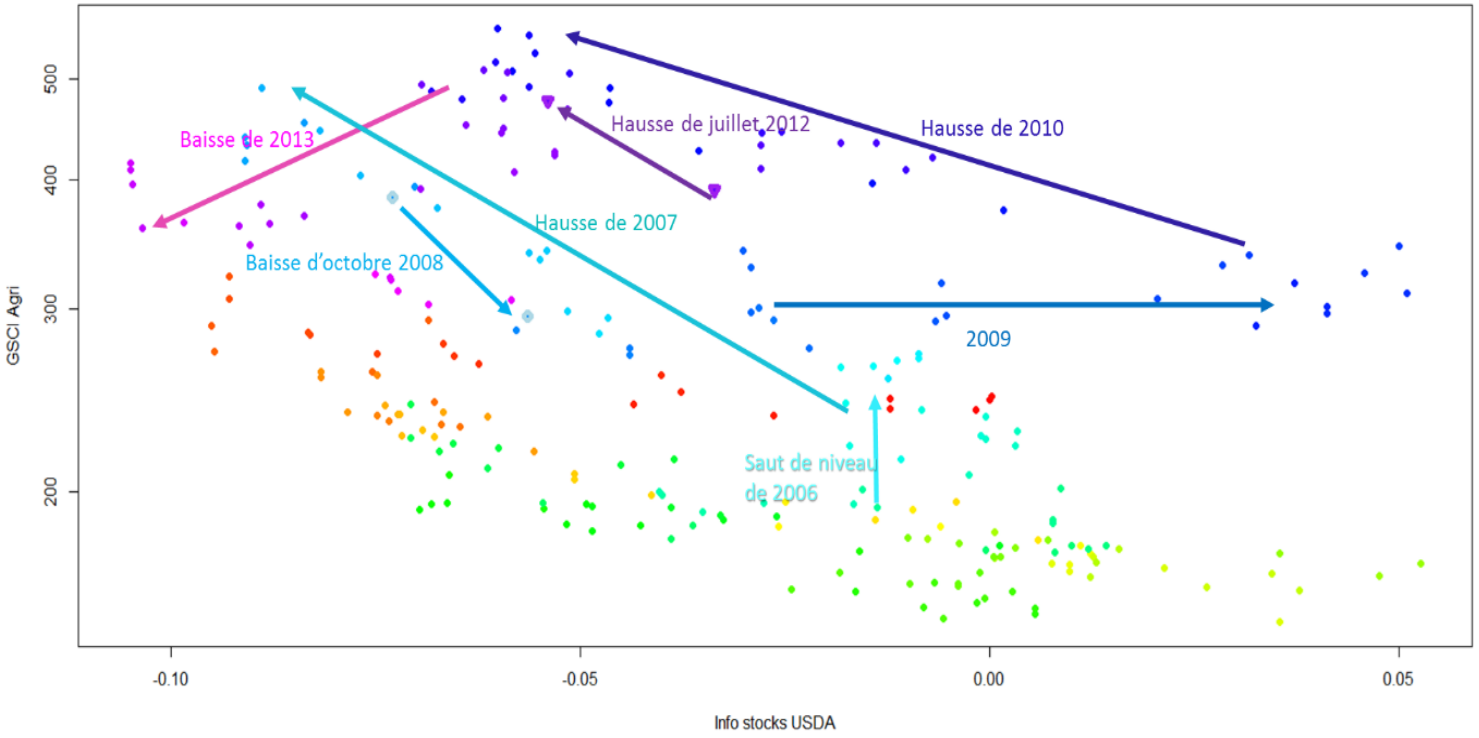
The stock-to-use/price relationship

- There is a strong negative relation between stock-to-use and price
- Breaking points may either correspond to decorrelation or recorrelation shocks
- A breakdown of correlation signals a long-term shift in supply/demand fundamentals or an unusual appetite for commodities on the part of investors
- Recorrelation generally implies extreme moves (up or down)

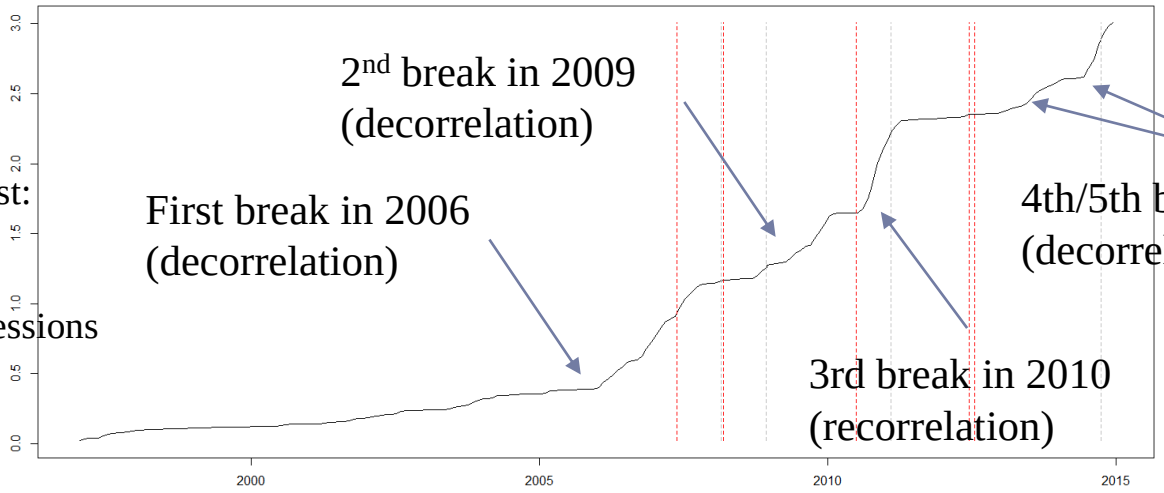
Breaks in the stock-to-use/price relationship



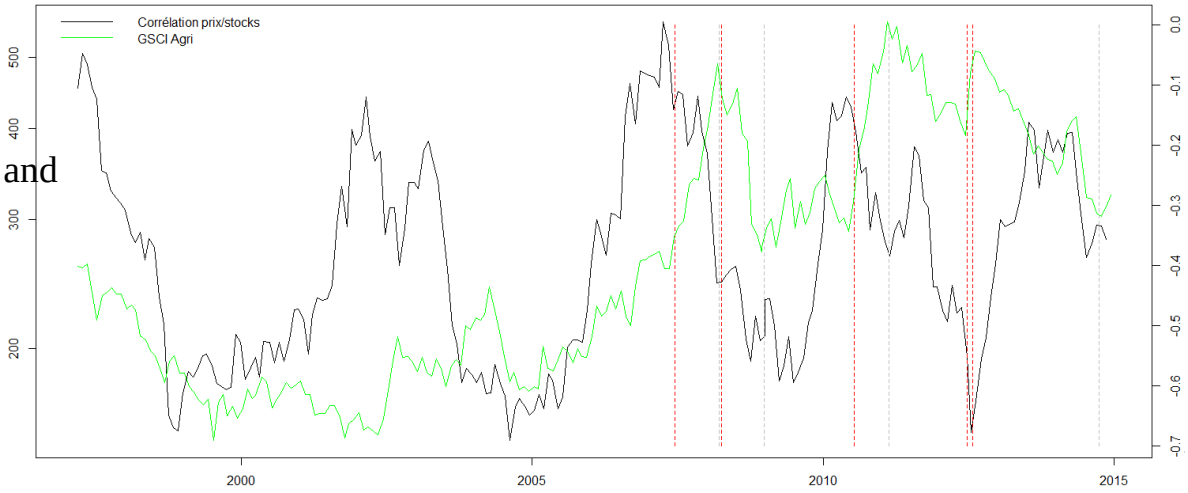
The STU/price variation has been subject to various breaks over the past decade

Breaks in the stock-to-use/price relationship

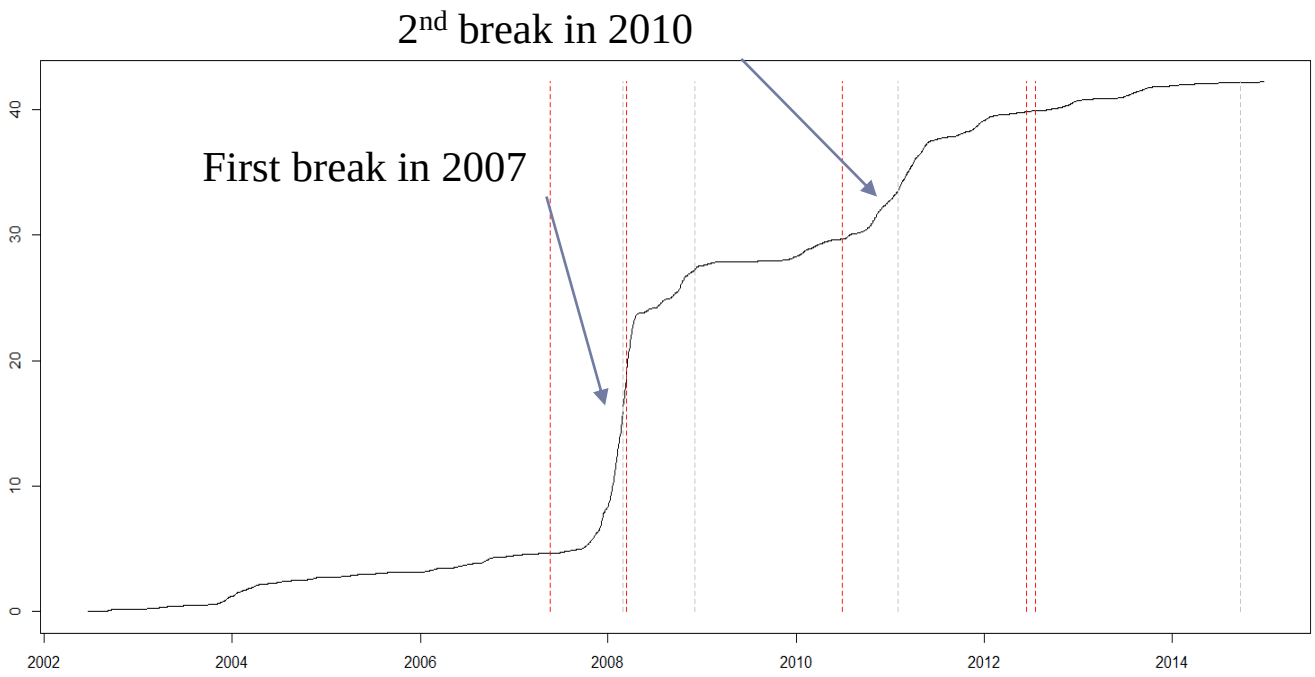
« CUSUM squared » test: Cumulative sum of squared last residuals from rolling linear regressions



Rolling correlations between STU variations and price returns



Breaks in the one year calendar spread/price relationship



The « calendar spread » (spread between one-year-out and first-nearby) is a useful proxy of the inventory level

This is a pure price-based signal…

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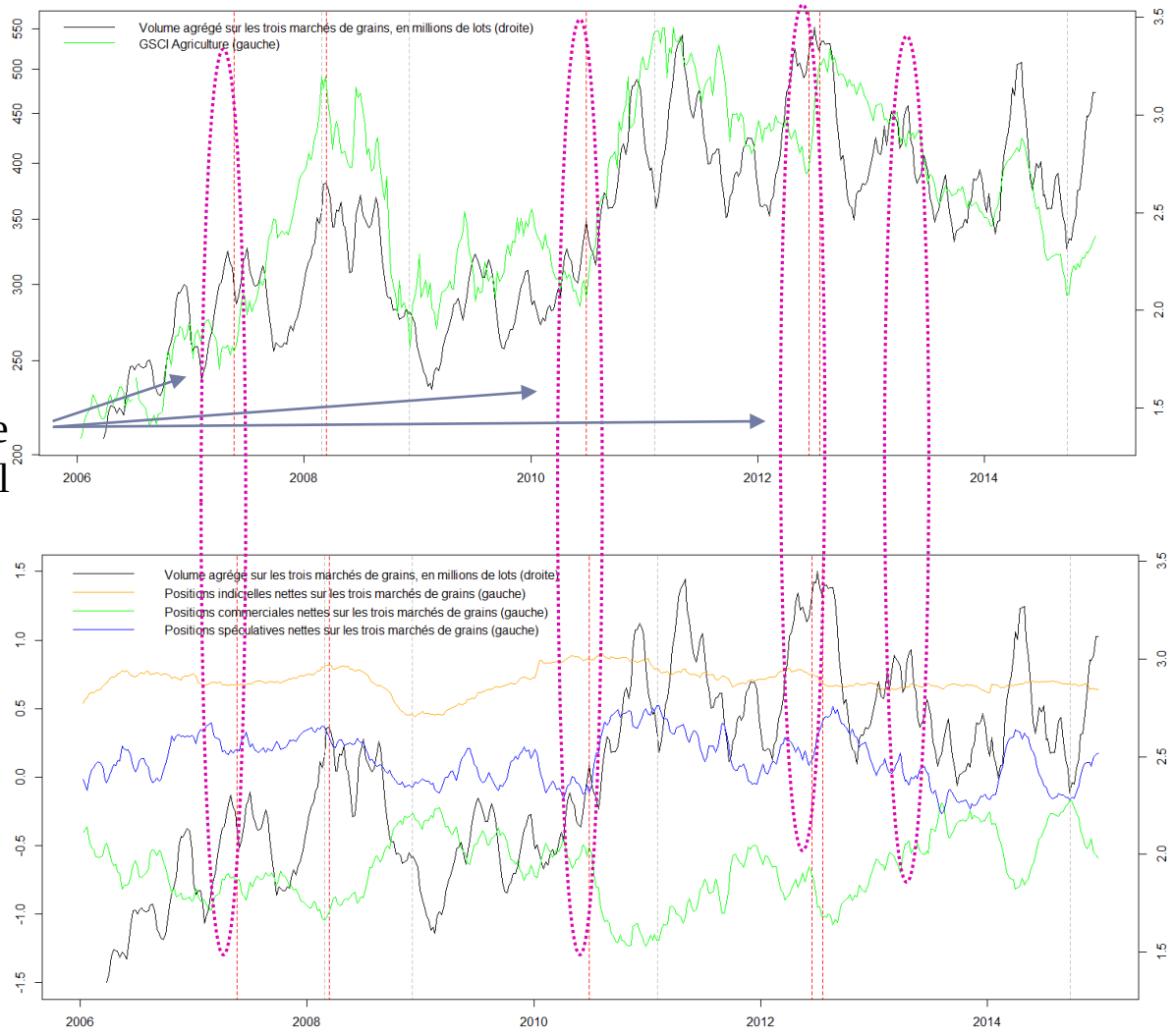
Volume information

- The literature documents a positive relation between volume and price changes in equity markets, that goes both ways:
  - Volume surges often reflect new buying interests from investors who are not part yet of the capital
  - Only attention-grabbing stocks have the potential to attract buying interests since there are plenty of stocks from which investors may pick
  - Volumes on the selling side come mostly from present stockholders (shorters are rare)
  - Price rises grab the attention of investors and predict increased volumes
  - High volumes grab the attention of investors and predict increased volumes/prices
  - High volumes may reflect the exploitation of private information by « insiders » and predict future price rises
- But commodity markets are different
  - The situation is much more symmetric between buyers and sellers due to the importance of producers' short positions
  - The number of potential buys/sells is much more limited

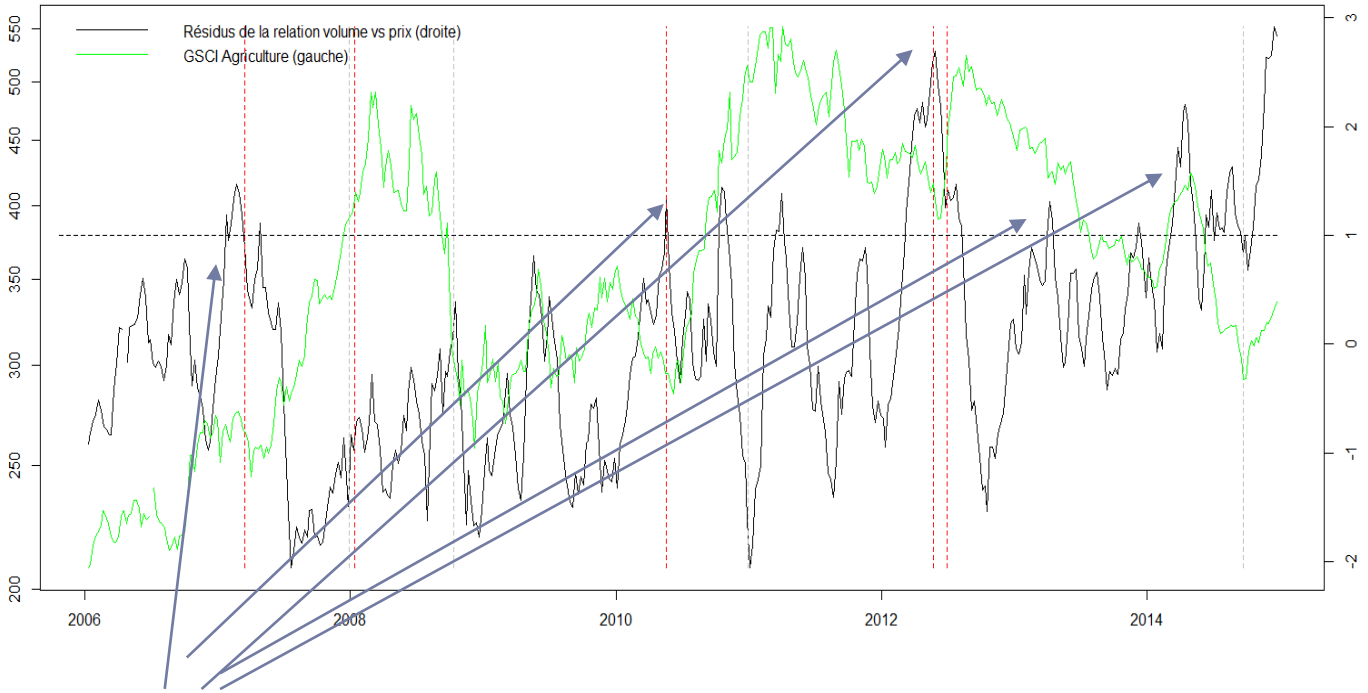
Deviations to the long-run volume/price relationship

Volumes increase
Prices and OI fall



Remark: aggregate weekly volumes on all maturities, 3 CBOT grain markets, 3-month moving average

Deviations to the long-run volume/price relationship



signals

Outline

- Motivation and main results
- The 2006/2007 structural jump
- Identification of five agricultural prices extreme moves
- Explanation by stock-to-use and index flows information
- Prediction
  - Price-based signals
  - Stock-to-use signals
  - Flows/volumes signals
- Conclusion

Conclusions

- Structural jump in grain prices in 2006/2007
- 5 extreme moves identified since 2007
- STU and index flows explain a variable part of these moves
- 5 predictive signals identified
  - 3 price-based signals
  - Breaks in the STU/price relationship
  - High volumes wrt the volume/price long run relation
- False signals may be minimized by reconciling these predictive signals
- Future work: out-of-sample analysis on future exteme moves …